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Oxidation-Resistant Silicide Coating Applied to Columbium Alloy Screen

A process for applying an oxidation-resistant disilicide coating to C-103 columbium alloy (Cb-10Hf-1Ti) wire screens produces screens that are capable of withstanding the temperature cycling in special transpiration-cooling systems. In these systems, the screens must remain effective for at least ten 15-minute cycles, during which they are sequentially heated to 1644 K (2500° F) in air and then cooled rapidly to room temperature. The coatings successfully protected the wire screens during transpiration-cooling tests in a plasma tunnel and with flames providing heat fluxes of 339 to 565 kW/m² (30 to 50 Btu/ft²-sec).

The coating operation is carried out in a 12.7 cm (5 in.) diameter fluidized bed reactor. The bed consists of 100% silicon powder, and the fluidizing gas is argon, with iodine vapor as the activator. The columbium alloy screen specimens are attached to tantalum wire fixtures suspended in the bed. Silicon tetraiodide formed in the gas phase decomposes at the surface of the specimens, and the surface layers are converted to columbium disilicide (CbSi₂).

The thickness of the coating is dependent on time, temperature, and activator concentration. For instance, a coating cycle of 8 hours at 1338 K (1950° F) produced coatings of 0.005 to 0.010 cm (0.002 to 0.004 in.) thickness on 0.05 cm (0.02 in.) screens. The coatings are uniform and are resistant to thermal cycling. The coated screen provides a porous surface that is

effective at temperatures well above those limiting the usefulness of superalloy screens.

Notes:

1. The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.95)

Reference:

NASA-CR-73246 (N68-33016), Transpiration Cooling System Development for Reentry Vehicles

2. Technical questions may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B71-10229

Patent status:

No patent action is contemplated by NASA.

Source: R. T. Torgerson of
The Boeing Company
under contract to
Ames Research Center
(ARC-10186)

Category 04